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RADER FISHMAN & GRAUER PLLC
LION BUILDING
1233 20TH STREET N.W., SUITE 501
WASHINGTON, DC 20036

EXAMINER

EDWARDS, PATRICK L

ART UNIT	PAPER NUMBER
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2621

DATE MAILED: 04/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/933,822

Applicant(s)

MICHEL, XAVIER

Examiner

Patrick L Edwards

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 October 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

1. The response received on 18 October 2004 has been placed in the file and was considered by the examiner. An action on the merits follows.

Response to Arguments

2. The applicant's arguments, filed on 18 October 2004, have been fully considered. A response to these arguments is provided below.

35 USC 112 First Paragraph Rejections

Summary of Argument:

In the previous office action, claims 1-2, 4-5, and 10-12 were rejected under 35 USC 112(1) as failing to comply with the written description requirement.

Regarding claims 1, 4-5, and 10-12: Applicant traverses the rejection to the term "edge enhancement means" by pointing to the edge builders shown in Figure 1 and the portion of the specification that describes that these edge builders "filter image data in the vertical and horizontal direction to edge-enhance the image" (applicant's remarks, pgs. 7-8). Applicant argues that this is adequate written description for the claimed "edge enhancement means."

Regarding claim 2: Applicant traverses the rejection to the terms "loose connection" and "tight connection" by pointing to excerpts of the specification and providing further clarification and explanation of these two terms. Specifically, applicant states that the term "loose connection" describes an image that is difficult to enlarge because of its low resolution and small amount of reliable information, and that the term "tight connection" describes an image with a high resolution and a sufficient amount of reliable information (see applicant's remarks pg. 8, second paragraph).

Examiner's Response:

Regarding claims 1, 4-5, and 10-12: Applicant's arguments have been fully considered and are persuasive. Applicant has pointed out a portion of the specification which provides support for this limitation. The previous rejection is hereby withdrawn.

Regarding claim 2: Applicant's arguments have been fully considered, but are not persuasive. Applicant refers to several portions of the specification and alleges that these cited excerpts provide support for the limitation. However, these excerpts are the exact same paragraphs that the examiner cited in the previous action as merely showing an example of a loose connection, but failing to provide a clear definition. Furthermore, the explanation provided by the applicant is inconsistent with the claimed terms. Applicant states that these terms refer to different types of images (i.e. a low resolution image versus a high resolution image: see applicant remarks pg. 8). The claim, however, indicates that a loose connection is a part of an original image ("converting a loose connection of said original image"); and that a tight connection is simply an edge converted loose connection. Consequently, these two terms—as currently claimed—still lack proper written description.

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35 USC 112 Second Paragraph Rejections

Summary of Argument:

In the previous office action, claims 2-3, 8, and 10 were rejected under 35 USC 112(2) as failing to particularly point and distinctly claim the invention.

Regarding claim 2: Applicant argues that the terms “loose connection” and “tight connection” are definite, and that the calculation of local energy is not required prior to performing the edge connection process (see remarks pg. 8-9).

Regarding claim 3: Applicant has amended the claim and argues that the prior rejection should be withdrawn.

Regarding claim 8: Applicant has amended the claim to correct the paradoxical claim language and argues that the prior rejection should be withdrawn.

Regarding claim 10: Applicant has amended the claim to correct the existing ambiguity, and argues that the prior rejection should be withdrawn.

Examiner's Response:

Regarding claim 2: In the previous office action, claim 2 was rejected under 112(2) because (1) the metes and bounds of the terms “loose connection” and “tight connection” were not clear; and (2) the claim contradicted its parent claim. This claim is still rejected for both reasons.

With respect to the first reason for rejection, the metes and bounds of the two terms are not clear for the reasons stated in the above “examiner's response” to the 112(1) rejection.

With respect to the second reason for rejection, the applicant's arguments have been fully considered but are not persuasive. In support of the argument that a calculation of local energy is not required prior to performing the edge correction process, the applicant states the following: “[T]he local energy calculation is based on the diagonal energy (right, left). Therefore, it is clear from the specification that the right diagonal energy and left diagonal energy associated with the edge connection process is not analogous to the local energy.” The examiner respectfully disagrees with the statement that the right and left diagonal energy is not local energy. Thus, the language of claim 2 still appears to be contradictory with respect to its parent claim, and is therefore indefinite.

Regarding claims 3, 8, and 10: Applicant's amendment and corresponding arguments are persuasive. The prior rejections to these claims are hereby withdrawn.

Prior Art Rejections

Summary of Argument:

Regarding claims 1, 11, and 12: Applicant has amended these claims by adding the limitation that local energy is calculated based on two rows of pixels in the original image. Applicant argues that Aoyama does not teach this limitation (remarks pg. 11). Further, applicant argues that Aoyama does not perform any edge enhancement operations (remarks pg. 12).

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Regarding claim 4: Applicant argues that Moronaga does not disclose a one-dimensional filter which is based on the results of a local energy calculation (see remarks pg. 13). Applicant admits that Moronaga discloses a one-dimensional filter and acknowledges that this one-dimensional filter is based on the high frequency components data of an 8x8 block of pixels, but submits that the high frequency component data from the 8x8 matrix does not qualify as the claimed "local energy."

Regarding claim 8: Applicant's claim amendment has rendered the previous rejection moot. A new rejection will be provided below.

Regarding claim 9: Applicant's claim amendment has rendered the previous rejection moot. A new rejection will be provided below.

Examiner's Response:

Regarding claims 1, 11, and 12: The examiner disagrees. The lattice disclosed in Aoyama consists of two rows. Applicant's arguments regarding edge enhancement fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. This limitation was discussed in the previous office action and is repeated below.

Regarding claim 4: The examiner disagrees. Applicant is reminded that the claims are given their broadest reasonable interpretation consistent with the specification, but that limitations from the specification are not read into the claims (see MPEP § 2106). The high frequency components of an 8x8 matrix of pixels in Moronaga qualify as the claimed "local energy." However, even if we assume, *arguendo*, that Moronaga does meet this limitation; the claim is still anticipated by the combination of aoyama and moronaga, since the aoyama reference was used for the local energy limitation.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 2 and 3 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

With regard to claim 2, the specification mentions the terms 'loose connection' and 'tight connection' in several different places (and provides repeated recitations of a single example of a loose connection such as in paragraphs [0063] and [0075]), but fails to provide a clear definition for these terms.

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Claim 3 is rejected because it depends from claim 2.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 2 and 3 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With regard to claim 2, the metes and bounds of the terms “loose connection” and “tight connection” are not clear as recited in the claims. The specification provides an example of a loose connection in an image (paragraph [0174] of the applicant’s specification), but fails to provide a clear definition of either term.

Further referring to claim 2, the claim recites converting a loose connection of an original image into a tight connection prior to calculating the local energy. This conversion process, which the applicant defines as an ‘edge connecting process’ in the specification (see paragraph’s [0165] and [0174]), requires prior knowledge of edge direction (see paragraph [0174]). Claim 2, however, recites performing this process before the calculation of local energy. Since edge direction detection is based on local energy (per claim 1), it isn’t clear how this ‘edge connecting process’ can be performed prior to the calculation of local energy. It appears as if claim 2 is in contradiction with the claim from which it depends.

Claim 3 is rejected because it depends from claim 2.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claims 1, 5-7, 11 and 12 are rejected under 35 U.S.C. 102(e) as being anticipated by Aoyama et al. (USPN 6,535,651).

With regard to claim 1, which is representative of claim 11, Aoyama discloses an energy calculating means for calculating local energy of an original image based on two rows of pixels (col. 38 lines 7-8 in conjunction with Figure 14). The ‘image density gradient vector’ disclosed in Aoyama qualifies as ‘local energy’ as recited in the claim. As can be seen in Figure 14 (and many of the other figures as well), this calculation is based on two rows of pixels (pixels Sa and Sb being on one row; and pixels Sc and Sd being on a second row).

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Aoyama further discloses a detections means for detecting the direction of an edge on the basis of the local energy calculated by the energy calculating means (col. 42 line 60 – col. 43 line 4 and col. 25 line 65 – col. 26 line 6).

Aoyama further discloses interpolation means for interpolating a new pixel from a pixel of said original image on the basis of the direction of the edge detected by the detection means (col. 29 line 14 – col. 30 line 56). The cited Aoyama excerpt shows several examples of how a new pixel is interpolated on the basis of the detected edge direction.

Aoyama further discloses edge enhancement means for performing an edge enhancement process on the basis of said local energy calculated by said energy calculating means (col. 35 lines 29-67 and col. 39 lines 36-48 in conjunction with Figure 12). The combination of elements 44', 43', 45' and 60 as disclosed in Figure 12 of Aoyama is analogous to the claimed edge enhancement means. The cited passage details how the 'local energy' (i.e. the image density gradient vector) is used to determine coefficients for a coefficient correction operation which is analogous to the claimed 'edge enhancement process' in that it produces sharp image edge portions (col. 39 lines 47-48).

The limitations recited in the preamble of the claim which are not included in the claim body have not been given any patentable weight and will not be discussed. Please refer to MPEP § 2112.02 for further information regarding limitations recited in the preamble of a claim.

With regard to claim 12, a computer-readable recording medium that stores a program which causes the computer to execute the steps of a method is essential if the image processing method disclosed in Aoyama is to function. Therefore, a computer-readable recording medium is inherent in the teachings of Aoyama.

With regard to claim 5, Aoyama discloses that the interpolation means and the edge enhancement means perform the interpolation and the edge enhancement upon the original image in vertical and horizontal directions (col. 33 line 57 – col. 34 line 3).

With regard to claim 6, Aoyama discloses interpolating one new pixel from two pixels lying along the detected edge direction (col. 29 lines 29-38).

With regard to claim 7, Aoyama discloses performing linear interpolation when the edge is not detected by the detection means (col. 4 lines 55-59). The 'flat portion' of the image as disclosed in Aoyama is analogous to the claimed situation where an edge is not detected by the detection means (aoyama col. 4 lines 19-28). Aoyama generically discloses an 'interpolating operation process' in the cited passage, but later goes on to specify that this interpolation process can be a linear interpolation (Aoyama col. 41 lines 13-14 and 50-51).

With regard to claim 10, Aoyama discloses that when the value of Z is greater than or equal to 2, the interpolation and edge enhancement operation are performed until Z is less than 2 (Aoyama col. 39 line 59-65: the reference describes that when the scale factor Z is greater than or equal to 2, it will perform the interpolation and edge enhancement step until Z is less than 2). Aoyama further discloses performing an interpolation when the Z value is less than 2 (i.e. setting the value of the interpolation coefficients in accordance with the scale factor). This interpolation qualifies as the claimed second interpolation.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aoyama as applied to claim 1 above, and further in view of Klassen (USPN 6,741,751). The arguments as to the relevance of Aoyama as applied above are incorporated herein.

With regard to claim 2, Aoyama fails to expressly disclose converting a loose connection of the original image into a tight connection before increasing the resolution of the image. Klassen, however, discloses connecting and strengthening edges in an image before increasing the resolution of said image (Klassen col. 3 lines 22-53). This operation (which is commonly referred to as anti-aliasing) is analogous to the claimed conversion of a loose connection to a tight connection, per the applicant's specification (see paragraph [0174]). It would have been obvious to one reasonably skilled in the art at the time of the invention to modify Aoyama's resolution increasing apparatus by connecting and strengthening the edges of an image before increasing resolution as taught by Klassen. Such a modification would have allowed for a system with improved rendition of text and synthetic graphics in the output image (Klassen col. 3 lines 43-44).

With regard to claim 3, Klassen discloses a system for anti-aliasing an input image before increasing its resolution (Klassen col. 5 lines 3-6). The claimed process of replacing the value of a particular pixel with the mean value of two pixels on the basis of pixels lying along a diagonal line is a common method of anti-aliasing which is very old and well known in the art (Official Notice). It would have been obvious to one reasonably skilled in the art at the time of the invention to specify that Klassen's anti-aliasing system replaced a pixel value with the mean value of two pixels lying along a diagonal line. Such a modification would have allowed for a simple and well known method of producing cleaner, more well defined edges in an image.

11. Claims 4 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aoyama as applied to claim 1 above, and further in view of Moronaga et al. (USPN 5,229,864). The arguments as to the relevance of Aoyama as above are incorporated herein.

With regard to claim 4, Aoyama discloses comparing a local energy calculation to a threshold to determine the existence of an edge, but fails to expressly disclose that the detected edges are enhanced by using a one-dimensional filtering process, such that the values of pixels are multiplied by corresponding coefficients of a 1-D edge building filter which include a scaling factor, and the respective products are added together. Moronaga, however, explicitly recites a one-dimensional filter for edge enhancement (Moronaga col. 6 lines 38-68). It would have been obvious to

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one reasonably skilled in the art at the time of the invention to modify Aoyama's image processing apparatus by enhancing the edges with a 1D filter as taught by Moronaga. Such a modification would have allowed for well known method of accentuating the edges of the image (Moronaga col. 6 lines 65-68).

With regard to claim 14, Moronaga discloses a coefficient value between 0.5 and 1.4 (Moronaga col. 6 line 65).

12. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aoyama as applied to claim 1 above, and further in view of Sato (4,985,764). The arguments as to the relevance of Aoyama as applied above are incorporated herein.

Claim 8 recites a 'consistency judging means' for judging consistency in terms of an interpolated pixel. The claimed term 'consistency', is a value that is based on the differences between pixels. Aoyama teaches that pixels which lie on the same edge in an image have similar values (i.e. they have 'consistency') (Aoyama col. 25 lines 42-48). It follows that if the differences between pixels on a same line are large, then we can conclude from Aoyama's teachings that the line that connects those two pixels does not represent an edge. The Sato reference, however, explicitly (as opposed to Aoyama's implicit teaching) discloses performing linear interpolation to generate a second new pixel from two pixels lying along the detected direction of the edge when the consistency judging means determines that a value obtained by multiplying a first difference and a second difference is negative, wherein the first difference is obtained by subtracting the new pixel value from the pixel value of a pixel value located at the center of the upper row, and wherein the second difference is obtained by subtracting the pixel value of a pixel located at the center of the lower row from the new pixel value (Sato Figures 7a and 7b in conjunction with col. 7 lines 47 – col. 8 line 60: The reference describes a newly interpolated pixel P1 with a value of 255 (a white pixel) sandwiched between two pixels (the pixels directly above and below the interpolated pixel (ie the pixels at the center of the upper and lower row)) with values of 0. Subtracting the interpolated pixel from the upper pixel gives us a value of -255. Subtracting the lower pixel from the interpolated pixel gives us a value of 255. The results of these two subtraction operations give two oppositely signed numbers. Thus, the multiplication results in a negative number (i.e. there is no consistency; the edge was detected erroneously). Figure 7B describes generating a second new pixel when this situation occurs).

It would have been obvious to one reasonably skilled in the art at the time of the invention to modify Aoyama's interpolation apparatus by checking the consistency of pixels on a detected edge to ensure that the edge was not detected erroneously as taught by Sato. Such a modification would have allowed for less noise and prevented degradation of image quality (Sato col. 7 line 66 – col. 8 line 1).

13. Claims 9 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aoyama as applied to claim 1 above, and further in view of Ng et al. (USPN 5,450,531) and Russ (The Image Processing Handbook -- 1995). The arguments as to the relevance of Aoyama as applied above are incorporated herein.

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With regard to claim 9, which is representative of claim 13, Aoyama discloses calculating local energy, but fails to expressly disclose creating an energy map. Ng, however, discloses creating a gradient map for every pixel in an input image (Ng Figure 1 elements 12 and 14 with col. 4 line 67 – col. 5 line 5). The gradient magnitude map disclosed in Ng is analogous to the claimed energy map. It would have been obvious to one reasonably skilled in the art at the time of the invention to modify the Aoyama's energy calculating means by using the calculated local energies for each pixel to create an energy map as taught by Ng. Such a modification would have allowed for an apparatus that saved the calculated energy values for each pixel in an input image and consequently avoid repeated calculations. This would have made for a faster, more efficient system.

With regard to the added limitation Aoyama discloses calculating local energy, but fails to expressly disclose calculating the local energy by subtracting pixel values of pixels in a right column of the original image from corresponding pixel values of pixels located in a left column of the original image, calculating an absolute value for each pixel value difference, calculating a sum of the absolute values, wherein the pixels in the right column of the original image are diagonally spaced from the corresponding pixels in the left column of the original image. However, this method of calculating local energy is well known in the art as a Roberts cross operator. This is shown at pages 236-237 of Russ. It would have been obvious to one reasonably skilled in the art at the time of the invention to modify Aoyama's calculation of local energy by using a well known method for calculating a local energy map or gradient map as taught by Russ. Such a modification would have allowed for a local energy map that took edge direction into account and utilized a well known algorithm.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Dougall et al (USPN 5,019,903) discloses spatial interpolation between lines of a supersampled video signal
- Tai (USPN 5,054,100) discloses an edge-enhancing pixel interpolator
- Greggain et al. (USPN 6,219,464) discloses performing directional interpolation to generate an upsampled image
- Jayant et al. (US 2002/0006231) discloses a noise-eliminating adaptive edge detection and enhancement method.

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action.

Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick L Edwards whose telephone number is (571) 272-7390. The examiner can normally be reached on 8:30am - 5:00pm M-F.

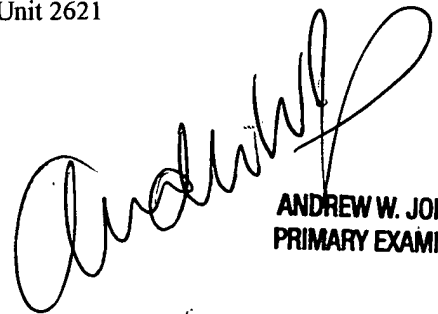
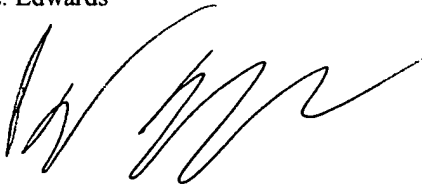
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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**ANDREW W. JOHNS
PRIMARY EXAMINER**